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Subject CLINTON LABORATORIES PROCESS MANUAL [redacted]
WASTE DISPOSAL WET D PROCESS [redacted]

By W. E. KIRST

To ______

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CLINTON LABORATORIES

PROCESS MANUAL

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Pages 5-a and 7-a have been added to Section 8-A

# WASTE DISPOSAL

## Process Description

All waste solutions and slurries containing varying amounts of radio active materials which require permanent storage are neutralized with 30% $Na_2CO_3$ solution and held indefinitely in underground concrete tanks. The floor drainage from Building 205 is collected in headers and transferred to underground hold-up tanks for analysis. If the contents are not too greatly contaminated by radioactive material, they are discharge through the retention ponds to the river. If sufficiently contaminated, they are diverted to the underground tanks for permanent storage. All cooling water from Building 205 and from the 100 Area is collected in one of two retention ponds and analyzed for radioactivity. If satisfactory, it is discharged to the river. By proper control, radioactive materials in these ponds should never reach a concentration where their discharge to the river is not possible, although it may be necessary infrequently to choose an optimum time or discharge in portions.

## Chemistry of the Neutralization with Sodium Carbonate

The chief interest here lies with the waste metal solution. As uranium is very expensive, it is possible that it may be recovered from this solution at a later date. At the same time since it is stored in underground tanks, the metal solution must be kept in such a condition that it can be removed by pumping.

It was originally intended to neutralize the waste metal solution with caustic soda. Treatment with this alkali, however, forms a heavy yellow precipitate that once accumulated in a large tank might be difficult to remove. If neutralized with soda ash, however, an unknown soluble complex uranium salt is formed and there is no precipitation.

The sodium carbonate solution can be added to the waste metal or the metal solution to the soda ash and the same results obtained. It is more convenient, however, to add the metal solution to the soda ash. In this way, the amount of foaming due to the liberation of $CO_2$ is reduced and better controlled. In addition, no precipitate forms if the proper amount of soda ash is used. If soda ash is added to the metal solution, however, a precipitate forms at first and then dissolves as more soda ash is added. In order to prevent this and control foaming, it is desirable to add the metal solution to the soda ash.

The amount used is not determined on a stoichometric basis but rather on the basis of laboratory experiments with solutions of known uranium content. These experiments gave a ratio at which a clear solution was obtained. As a factor of safety, the actual amount used is a 50% excess over this.

The exact uranium compound formed is not known and may be a double nitrate or phosphate with sodium carbonate. The compositions of the various wastes given later are somewhat arbitrary. In calculating them, all free acids were converted to sodium salts and the loss in weight from $CO_2$ and the gain in water by reaction were taken into account. The balance of the soda ash and all the uranyl nitrate, however, are shown as these compounds in the neutralized solution.

The neutralization of the aluminum jacket solution results in the formation of $Al(OH)_3$. If sodium hydroxide were used, the aluminum would be converted to the aluminate $NaAlO_2$ and remain in solution. The amount of this solid is so small, however, that no trouble is anticipated in transferring it to storage even with soda ash neutralization. Sufficient alkali is added to insure a pH of 9-11. Since at the present time the amount of soda ash to attain this pH is not known, the compositions shown later contain a 10% excess of soda ash over that required for reaction with the compounds present. This allows the use of soda ash for neutralizing all wastes and eliminates the special handling of sodium hydroxide.

The solution of the by product precipitates is readily neutralized to a pH of 9-11 with soda ash. After neutralization, it carries a precipitate of bismuth phosphate. This is small enough, however, to cause no handling troubles, and in addition, it could not be prevented by the use of caustic soda.

The filtrates from reduced 49 precipitations require no special consideration, these being merely neutralized with enough soda ash to give a **final** assumed pH of 9-11.

In all the neutralized compositions shown later, the soda ash has been added in 10% excess over the theoretical.

## Equipment

Cell 5 Equipment - Building 205.

This cell is similar to Cells 3 and 4 in that it could be used to carry out a complete purification cycle consisting of oxidation and reduction steps. As the facilities in Cells 3 and 4 are ample, however, Cell 5 probably will be used only for the neutralization of all wastes from Cells 2, 3, 4 and Room D. Consequently, only the neutralizing equipment will be described here.

Neutralizer Weigh Tank (205-252; Detail 58878)

This is a 2' diameter by 2'3" - 2'4" high, vertical, cylindrical, 25-12-S Cb welded tank with the bottom pitched 1" to the outlet. The capacity is 1.06 gals. per inch. It rests on a 1000# gross capacity Fairbanks Morse beam scale. The tank and scale are located in Room C.

Neutralizer (205-229; Detail 58871)

This is a 7' diameter by 9'4" high, vertical, cylindrical, 25-12 S Cb welded tank with convex ends. The center 7' is cylindrical, and the top and bottom sections are 14" deep. This tank has 4 symmetrically spaced, vertical, internal baffles fastened to the wall and projecting 6" from it at 90° for the length of the cylindrical section. Agitation is provided by a centrally located, vertical 25-12-S-Cb shaft fitted with 2 paddles of the same material (Detail 59732). The center of the lower paddles is 14" and of the upper paddle 3'8" from the extreme bottom of the tank. Each paddle consists of two 45° blades 4-1/2" wide and 8" long. The packing gland is 25-12-S-Cb. This agitator is driven by a 5 HP, 1150 RPM, 3 phase, 60 cycle, 440 volt T.E.F.C. motor through a Philadelphia Reducer (284 Type VSD) with an output speed of 150 RPM.

The neutralizer is fitted at the cylindrical section with a 6'4" high 18-8 jacket for cold water cooling. It also carries nozzles, and an 18" center opening in the cover for the agitator, which opening is normally closed by the packing gland assembly. The cover nozzles accommodate: (1) an inlet line from the neutralizer weigh tank, (2) a line from the catch tank of Cell 2, (3) a line from the centrifuge of Cell 2, (4) a line from the catch tank of Cell 3, (5) a line from the centrifuge of Cell 3, (6) a line from the catch tank of Cell 4, (7) a vent, (8) a sparger connected to air and steam, (9) the liquid level gage leads, (10) a thermometer well, (11) a sample opening, and (12) steam siphons for the delivery of neutralized wastes to the two 3" stainless drain lines.

## Permanent Storage of Neutralized Wastes

### General Arrangement of Underground Storages - Figure 1

All the permanent concrete storages are located below ground level and surrounded by a layer of 2' crushed stone for about 3 feet of their sides. The remaining space is filled in with earth, and all the tanks are covered with a layer of earth. That over the main metal solution and the temporary storages is 5'6" thick, and that over the slurry storages is 6 feet.

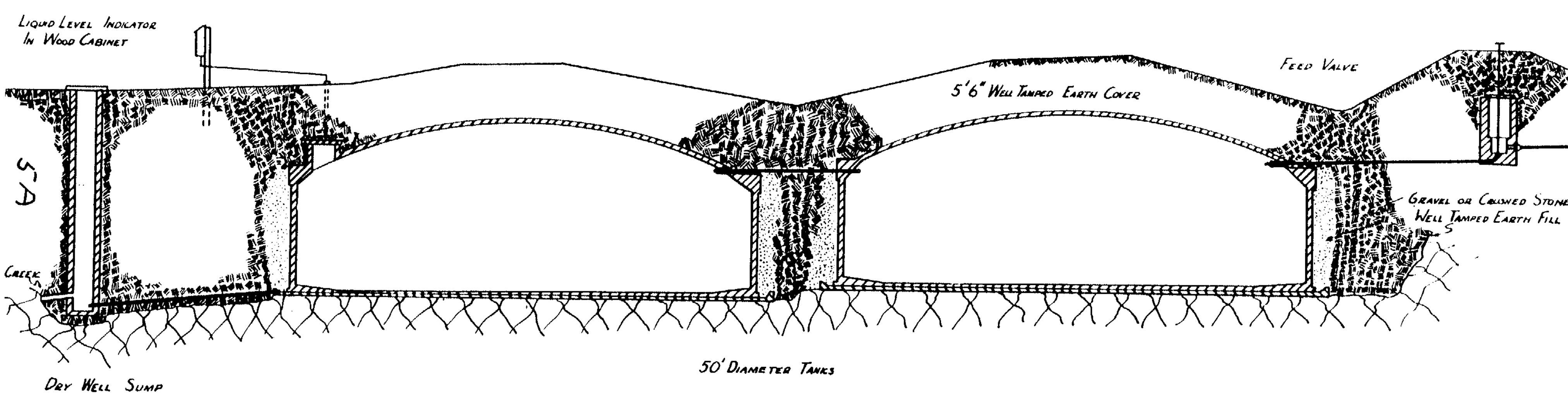
Each tank is provided with a so-called "dry well". This is a 2' x 2' concrete pit of sufficient depth to extend from ground level to a point below the pad on which the tanks rest. A 6" terra cotta line permits leakage collecting on the pad to drain into this well. It has a plank cover at the surface. There is a connection to a 6" terra cotta sewer line enough below the drainage inlet to give an 8" deep retention. This line in turn connects to an 8" one that discharges into a 25 x 25 x 3' deep earth retention pond from where the drainage overflows into the river. Periodic samples are taken from these dry wells for the determination of radioactivity.

The purpose of these wells is to permit sampling to determine if a tank is leaking. As surface water will percolate down and enter the well through the drain lines from the pads, this is allowed to drain away to the river through the 6" outlet.

### Underground Slurry Storage Tanks

Equipment pieces Nos. 206 121 and 122. These are two 25' diameter x 12' high Gunite storages painted internally with bitumastic paint. The bottoms are 3" thick, the sides are 5" at the bottom and 3-1/2" thick at

FIGURE I
MAIN METAL AND LIQUID WASTES STORAGE
TYPICAL SECTION



the top. Each tank has a water capacity of 367,500 pounds. Both tanks are provided with inlet nozzles, indicating thermometers, vents, Pneumer cator tubes to indicate the level of the contents, and 30" manholes and spare 4" and 12" nozzles all in the covers.

Each tank is built on a concrete pad covered with a mat. This mat consists of 2 plies of all cotton rag, asphalt impregnated, waterproofing fabric and a surface cover of Orange Label sisalkraft paper all cemented together with asphalt. The outer edges of each pad are equipped with a raised rim to collect any seepage on the pad and conduct it through a 6" terra cotta line to the dry wells.

Underground Solution and Liquid Storage Tanks

Equipment pieces Nos. 206 111 to 116 inc. There are six 50' diameter x 12' high, Gunite storages painted internally with bitumastic paint. The bottoms are 3" thick and the sides 6" at the bottom and 5" thick at the top. Each tank has a water capacity of 1,470,000 pounds. The covers of all tanks are provided with inlet nozzles, a vent, Pneumercator tubes to show the liquid level, and 30" manholes and spare 4" and 12" nozzles.

Three of these tanks are provided with waste inlet lines and over flow lines which connect to one of the three remaining tanks. This is done to give three separate storage systems of two tanks each. Each tank is built on a concrete pad covered with a mat similar to that just des cribed. These pads are provided with raised rims to collect any seepage collecting on them and to drain it to the dry wells through 6" terra cotta lines.

Underground Temporary Storages

Equipment pieces Nos. 206 102 and 103. There are two 12' diameter x 6' high Gunite storage tanks painted internally with bitumastic paint.

Each tank has a water capacity of 42,300 pounds. Both are provided with inlet nozzles, vents, Pneumercator tubes to show the height of the contents, and 30" manholes and spare 4" and 12" nozzles all in the covers. There is also an overflow at one side near the top to permit overflow to drain to the 15" terra cotta, cooling water sewer.

Each of the tanks is built on a concrete pad with a mat similar to those under the other tanks. The outer edge of the pad has a raised edge to collect any seepage draining from the pad and conduct it through a 6" terra cotta line to a dry well.

There is an 8' x 4'6" high, Gunite storage (tank 135) adjunct to the laboratory (Building 706). This has a diversion box to permit sending the waste either to the main liquid storages or the ponds, depending on the radioactivity present.

Temporary Storage Ponds

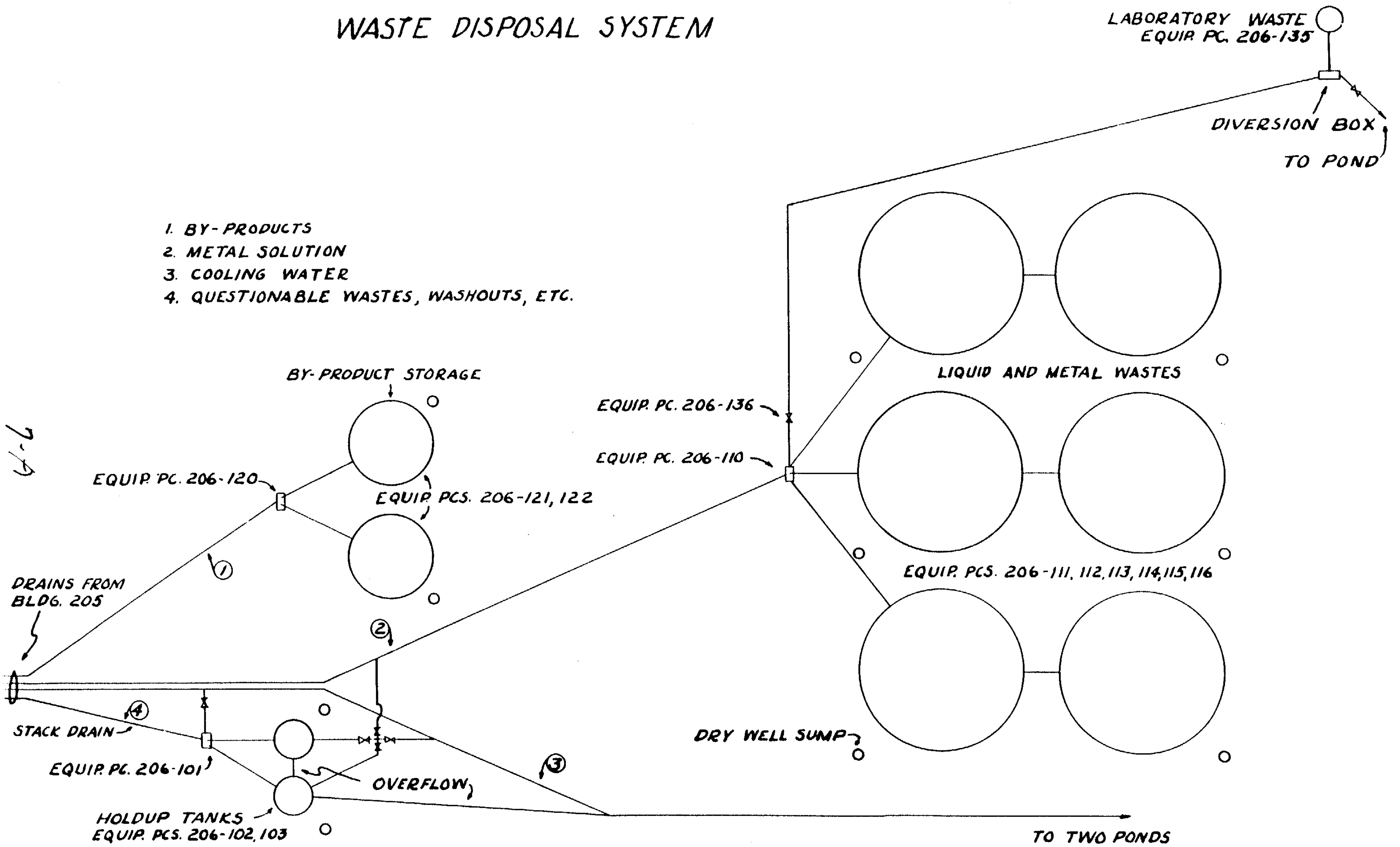
There are 2 retention ponds located beyond the waste storage tanks, each with a water capacity of approximately 225,000 gallons. These ponds are arranged so that all cooling water may be held temporarily for testing and dilution before discharge to the creek.

Collecting Lines - Figure 2

The following waste collection lines are located in an underground trench extending from the Building 205, Separation Plant, to the Waste Disposal Area. See Figure 10, Product Recovery Section.

1. One 3", 18-8-S Cb line with all-welded joints delivers by-product slurry wastes to the two storage tanks (206-121 and 122). This line is provided with a 3", 18-8-S Cb outlet from each cell except #1. At present, the neutralizer in Cell 5 is the only equipment connected to a cell outlet of this line.

# FIGURE 2
# WASTE DISPOSAL SYSTEM




7-A

2. A 3", 18-8-S-Cb line with all welded joints delivers all liquid wastes from cell 5, including the main neutralized metal solution and the solution of the aluminum jackets, to tanks 206-111 to 116. This line is provided with a 3", 18 8-S Cb outlet from each cell. At present, the neutralizer tanks in Cell 5 is the only equipment connected to a cell outlet of this line.

3. A 15" terra cotta line encased in concrete and having joints packed with Asbestos Rope and Atlas Mineral Products "G-K" compound collects cooling water from the 4" chemical-ware outlets of each of Cells 1, 2, 3, 4, 5 and 6, cooling water from the 100 Area, and drainage through a 4" chemical-wate line from the floor drains in the Control Room and Laboratory. This line discharges directly into the ponds. The cooling water from the 100 Area consists of overflow basin and water from the cooling of the 2 experimental water tubes in the pile.

4. A 6" chemical ware line encased in concrete and having joints packed with Asbestos Rope and Atlas Mineral Products "G-K" compound delivers waste to the temporary storage tanks. This line is joined by 4" chemical-ware lines from the floor drains in each cell, a 4" chemical-ware line from the tunnel floor drains, a drain from Room D and one from the fume stack. It also receives wastes from the "Hot Laboratory" in the pile building and drainage from the pile stack and fan house. There are valved outlets from the temporary storage tanks which connect to the 15" line to the ponds and to the 3" line to the main solution storages.

5. A 2" stainless line runs from the diversion box handling wastes from the Laboratory (Building 706) to the diversion box ahead of the main liquid storages. This line is valved to control flow and prevent the backing up of liquids into the low end.

6. There is a 4" terra cotta line from the storage tank at the Laboratory through which uncontaminated water is sent to the ponds.

Fume Stack

This is a 200' stack for disposal to the atmosphere of the gaseous wastes from the Building 205, Separation Plant. It is built of concrete and lined with acid brick set in acid resistant cement. The outer dia meter of this stack is 13'9" at the base, 7'6" at the top; while the inner diameter is 7' at the base, and 5' at the top. The thickness of the concrete is 12" at the base, and 6" at the top; and that of the acid brick is 13 1/2" at the base, and 4 1/2" at the top. There is a 15" air space between the concrete and the brick at the base and a 4 1/2" space at the top. The interior surface of the concrete is painted for the full height with an acid resistant compound, while the outside surface is painted for only a distance of 25 feet down from the top.

The base of this stack is provided with a 20 sq.in. breeching opening and a 2' x 3' clean-out door. A stainless steel, condensate collection pan is installed in the base, the drain from which is connected to the underground 6" chemical ware sewer line running to the temporary storage tanks. This stack is provided with a line for the taking of gas samples at a point 50 feet from the base.

Ventilating Fans

There are two 20,000 cu.ft. per minute fans, one steam and one elec trically driven which operate to give a total flow of 40,000 cu.ft. per minute.

These fans supply air for the dilution of the off gases from the dissolver. Each blower has a capacity of 20,000 c.f.m. at 757 r.p.m. against a static pressure of 2 1/2: $H_2O$. One is driven by a 20 HP, 1800

RPM, 3 phase, 60 cycle, 440 volt open electric motor through a "V" belt drive. The second is driven through a "V" belt drive by a Type "E" Troy Enberg 7" bore by 6" stroke, reciprocating steam engine operating on a steam supply at 100# gage and exhausting at 15# back pressure. Both blowers discharge through a common short breeching into the base of the waste gas disposal stack. Dampers are available with which to isolate either blower if this is required.

## Amounts and Composition of Various Wastes

The following are the four general types of waste:

1. Metal Jacket Solution. This results from the removal of the aluminum jackets of the uranium slugs and consists of a solution of aluminum nitrate with a considerable excess of nitric.

2. Waste Metal Solution. This contains the uranium in the form of the basic nitrate $UO_2(NO_3)_2$ along with free nitric, sulphuric and phosphoric acids. It is produced in Cell 2 where the crude 49 is separated from the reduced solution by means of a bismuth phosphate preci pitate.

3. By-Product Precipitate. This consists of a nitric acid solu tion of the bismuth phosphate carrier precipitate separated from the oxidized product solution. One such solution is made in Cell 2 and a second similar one is made in Cell 3, where purification is carried out. If sufficient purification is not accomplished in Cell 3, a third by-product precipitation will be made in Cell 4.

4. Filtrate from 49 Precipitation. The first of this type of solution results from the removal in Cell 3 of the 49 from the reduced solution by a bismuth phosphate precipitate. The chief constituents are nitric and phosphoric acids and ferrous ammonium sulphate.

A similar solution results from the concentration step in Cell 4 where lanthanum fluoride replaces bismuth phosphate as a carrier in the removal of 49 from a reduced solution. In this case, the solution contains nitric, phosphoric and hydrofluoric acids and sodium arsenite.

The following show the approximate compositions, weights, and volumes of the constituents of the various types of waste before and after neutralization.

Jacket Solution (Cell 1)

| | Original Sol. | | | Alkali Sol. | | | Neutralized Sol. | |
|---|---|---|---|---|---|---|---|---|
| Constituent | # | % | Constituent | # | % | Constituent | # | % |
| Water | 864 | 90.5 | Water | 121 | 70 | Water | 968 | 88.35 |
| $HNO_3$ | 16 | 1.7 | $Na_2CO_3$ | 52 | 30 | $NaNO_3$ | 97 | 8.9 |
| $Hg(NO_3)_2$ | 0.25 | 0.03 | | | | $Hg(NO_3)_2$ | 0.25 | |
| $Al(NO_3)_3$ | 63 | 6.6 | | | | $Al(OH)_3$ | 23.0 | 2.1 |
| $UO_2(NO_3)_2 6H_2O$ | 2 | 0.2 | | | | $UO_2(NO_3)_2 6H_2O$ | 2.0 | 0.2 |
| | | | | | | $Na_2CO_3$ | 5.0 | .95 |
| Totals | 954 | 100 | | 173 | 100 | | 1097 | 100 |
| Total Vol. Gals. | 108 | | | 16.2 | | | 124.2 | |

Soda ash based on neutralization of $HNO_3$, conversion of $Al(NO_3)_3$ + 10% excess.

Total solids approx. 23 lbs., 2.1%.

## Waste Metal (Cell 2)

| Original Sol. | | | Alkali Sol. | | | Neutralized Sol. | | |
|---|---|---|---|---|---|---|---|---|
| Constituent | # | % | Constituent | # | % | Constituent | # | % |
| Water | 5526 | 71.0 | Water | 5460 | 70 | Water | 11241 | 74.0 |
| $HNO_3$ | 44.5 | 0.6 | $Na_2CO_3$ | 2340 | 30 | $NaNO_3$ | 58 | .4 |
| $UO_2(NO_3)_2 6H_2O$ | 1412 | 18.2 | | | | $UO_2NO_3 6H_2O$ | 1412 | 9.2 |
| $H_2SO_4$ | 302 | 3.9 | | | | $Na_2SO_4$ | 438 | 3.0 |
| Rare Earth Oxides | 6.5 | 0.1 | | | | Rare Earth I. Oxides | 6.5 | |
| $H_3PO_4$ | 483 | 6.2 | | | | $Na_3PO_4$ | 783 | 5.3 |
| | | | | | | $Na_2CO_3$ | 1253 | 8.3 |
| Totals | 7774 | 100 | | 7800 | 100 | | 15191.5 | 100 |
| Total Vol. Gals. | 786 | | | 736 | | | 1522 | |

Total solids unknown but small.

## By-Product Ppt. Solutions (Cells 2 and 3)

| Original Sol. | | | Alkali Sol. | | | Neutralized Sol. | | |
|---|---|---|---|---|---|---|---|---|
| Constituent | # | % | Constituent | # | % | Constituent | # | % |
| Water | 705 | 618 | Water | 1015 | 70 | Water | 1699.0 | 708 |
| $HNO_3$ | 473 | 36.3 | $Na_2CO_3$ | 437 | 30 | $NaNO_3$ | 638.0 | 26.6 |
| $NaBiO_2$ | 5 | 0.4 | | | | $Na_2BiO_2$ | 5.0 | |
| $BiPO_4$ | 24.4 | 1.9 | | | | $BiPO_4$ | 24.4 | 1.0 |
| | | | | | | $Na_2CO_3$ | 40.0 | 1.6 |
| Totals | 1307.4 | 100 | | 1452 | 100 | | 2406.4 | 100.0 |
| Total Vol. Gals. | 120 | | | 136 | | | 256 | |

Soda ash based on neutralization of $HNO_3$ + 10% excess.

Total solids approx. 29.4 lbs. = 1.2%.

## Filtrate from 49 Precipitation (Cell 3)

Includes dilution due to jetting.

| Original Sol. | | | Alkali Sol. | | | Neutralized Sol. | | |
|---|---|---|---|---|---|---|---|---|
| Constituent | # | % | Constituent | # | % | Constituent | # | % |
| Water | 9956 | 88.5 | Water | 3854 | 70 | Water | 14045 | 87.1 |
| $HNO_3$ | 598 | 5.3 | $Na_2CO_3$ | 1646 | 30 | $NaNO_3$ | 803 | 4.95 |
| $H_3PO_4$ | 589 | 5.2 | | | | $Na_3PO_4$ | 960 | 5.95 |
| $Fe(NH_4)SO_4 6H_2O$ | 118 | 11 | | | | $FeCO_3$ | 80 | 0.50 |
| | | | | | | $(NH_4)_2SO_4$ | 46 | 0.30 |
| | | | | | | $Na_2SO_4$ | 50 | 0.30 |
| | | | | | | $Na_2CO_3$ | 150 | 0.90 |
| Totals | 11229 | 100 | | 5500 | 100 | | 16134 | 100 |
| Total Vol. Gals. | 1256 | | | 513 | | | 1769 | |

Soda ash added to neutralize free acids and decompose $Fe(NH_4)SO_4$ + 10%.

Total solids approx. 46# = .3%

## Filtrate from 49 Concentration (Cell 4)

| Original Sol. | | | Alkali Sol. | | | Neutralized Sol. | | |
|---|---|---|---|---|---|---|---|---|
| Constituent | # | % | Constituent | # | % | Constituent | # | % |
| Water | 10205 | 92.4 | Water | 2785 | 70 | Water | 12173 | 89.7 |
| $HNO_3$ | 511 | 4.6 | $Na_2CO_3$ | 1195 | 30 | $NaNO_3$ | 700 | 5.15 |
| $H_3PO_4$ | 80 | 0.1 | | | | $Na_3PO_4$ | 135 | 1.0 |
| HF | 202 | 1.9 | | | | NaF | 414 | 3.05 |
| $NaNO_3$ | 15 | 0.1 | | | | $La(OH)_3$ | 6 | |
| $La(NH_4)(NO_3)_2 4H_2O$ | 12 | 0.1 | | | | $NaAsO_2$ | 45 | 0.3 |
| $As_2O_3$ | 29 | 0.2 | | | | $Na_2CO_3$ | 110 | 0.8 |
| Totals | 11054 | 100.0 | | 3980 | 100 | | 13583 | 100.0 |
| Total Vol. Gals. | 1282 | | | 372 | | | 1654 | |

Soda ash added to neutralize $HNO_3$, $H_3PO_4$, HF react with $LaNH_4(NO_3)_2$ + 10% excess

Total solids approx. 6 lbs. = .05%

## Operating Details

There are no special precautions to be observed in the neutralizations of the various wastes except that the waste metal solution is added to the soda ash solution. This may be done with the other wastes but is not essential.

### Neutralizing Vessels

The various wastes are all neutralized in the neutralizer of Cell 5.

### Transfer of Neutralized Solutions to Storage

The neutralized wastes are sent to storage as follows:

1. The aluminum jacket solution is sent through one of the 3" - 18 8 lines to the slurry storages 206 121 or 122.

2. The waste metal solution is sent through the second 3" - 18 8 line to the liquid storages 206 - 111 to 116 inclusive.

3. By-product precipitate solutions are sent through the first 3" 18-8 line to the slurry storages 206 121 or 122.

4. Product precipitate filtrates are sent through the second 3" - 18 8 line to the liquid storages 206 -121 to 116 inclusive.

### Miscellaneous Wastes

These consist of the following:

1. Fume Stack Condensate. This is small in amount and runs from a stainless collecting pan in the base of the stack to the 6" underground chemical ware header and in this to the temporary storage tanks 206 - 102 or 103.

2. Cooling Water from Process Vessels. This includes all jacket and coil discharges. This leaves the various cells through 4" chemical ware outlets and is transferred by the 15" terra cotta sewer to the settling ponds.

3. Washings. These include all wastes from the floor drains in each cell, the Pipe Tunnel, Room D and the Control Room. The amount and com position depends on spills and washdowns of equipment. It is sent to the temporary storages 206 102 or 103 for analysis for radioactivity prior to disposal.

Gaseous Wastes

Gaseous wastes are removed from each vessel in the cells, except the dissolver, by venting the cell rooms into a fume duct which discharges into the 200' fume stack. Suction is provided by two 20,000 cu.ft. per minute fans, a total of 40,000 cu.ft. Since the dissolver in Cell 1 is the chief source of gaseous wastes, it is vented separately and directly into the fume stack by a steam jet exhauster. The solution of 1/3 ton of metal produces $NO_2$, NO and variable small amounts of radicactive xenon and iodine, (See Metal Solution Section). For safety, it is necessary that this be diluted to approximately 1 cc. per 1,000,000 cubic meters. The gases from the fume stack are diluted by the 40,000 cu.ft. per minute discharge of the two fans, which amount is in excess of that required for adequate dilution of the xenon. The details of the amount of xenon pre sent may be found in the Section on Metal Solution.

Storage of Neutralized Radioactive Waste Solutions

These consist of the main metal solution, filtrates from the decon tamination area, and badly contaminated wash waters.

Method of Operation

The neutralized metal solution or the filtrates flow by gravity through the 3" 18-8 S-Cb underground line into the concrete diversion box ahead of the main solution storages. This box has three bottom out lets equipped with lever-operated 18-8-S Cb plug valves that permit the material to be diverted to any of the three tanks for permanent storage. Each tank has an overflow line connected to one of the three remaining tanks to provided three separate 2 tank storage systems. Each of the six tanks is provided with a spare nozzle in the cover through which a pump or siphon line may be installed to remove the contents.

Control Methods

For control purposes, the main solution storages are provided with the following:

1. Pneumercator tubes for determining the liquid level, the gages for which are located in a small weather proof box at ground surface and near the storage.
2. Spare 4" nozzles in the cover extending to the surface level to permit sampling.
3. Dry wells adjacent to the tanks to collect any liquid accumulated by the concrete pads on which the tanks rest. These wells extend to surface level from where samples may be taken to determine if the tank is leaking.

Storage of Neutralized By-Products Precipitate Solutions

These wastes are handled as follows:

The neutralized by product precipitate solutions flow by gravity through the 3" - 18-8-S-Cb underground line into a concrete diversion box ahead of the slurry storages. This box has two bottom outlets equipped with lever operated, 18 8-S-Cb plug valves which permit the material to be diverted to either tank 121 or 122 for permanent storage.

Control Methods

For control purposes these tanks are provided with the following:

1. Pneumercator tubes for determining the liquid level, the leads of which are arranged as just described.

2. Indicating thermometers for checking the temperatures.

3. Spare 4" nozzles in the cover extending to surface level to permit sampling or removal of the contents.

4. Dry wells located adjacent to the tanks to collect material accumulated by the concrete pads on which the tanks rest. These wells rise to surface level from where samples may be taken to determine tank leakage.

Disposal of Cooling Water and Floor Drainage

Method of Operation

The cooling water and the floor drainage from the Control Room and the Laboratory flow by gravity through the underground 15" terra cotta header to either of the two ponds. The ponds are allowed to fill alternately and after filling, a pond is tested for contamination before it is discharged to the creek.

The wastes from the floor drains in the cells, the Pipe Tunnel and Room D and the fume stack drain flow by gravity through the underground 6" chemical-ware line to a diversion box ahead of the temporary storages. From here they flow by gravity to the storage tanks where they are held while being tested for contamination. Depending on the results, these wastes are then allowed to flow by gravity through the bottom outlets to the 15" terra cotta line to the ponds or through the 3" 18-8-S-Cb line to the permanent solution storages.

Allowable Radioactivity in Waste Discharge to River

The maximum allowable radioactivity that may be discharged into the river is such as to give a total exposure of .1 r based on 2 Mev gamma to a fish or an animal immersed in it for 24 hours. The action of beta radiation of similar intensity would be about the same, except that the penetrating power is much less than gamma rays and consequently, a somewhat greater exposure can be tolerated.

This amount corresponds to $1.6 \times 10^{11}$ ion pairs per 24 hours per gram, or $1.87 \times 10^{6}$ pairs per second per gram. It may also be expressed as 60 Mev per second per gram which, at 2 Mev level, would give 30 disintegrations per second per gram. This latter figure corresponds to $8.1 \times 10^{10}$ curies per cc., or $2.3 \times 10^{5}$ curies per cubic foot. The concentration is determined by counting a definite sample.

Control Methods

For control purposes the temporary storages are provided with the following:

1. Pneumercator tubes for determining the liquid level, the leads of which run to a gage located nearby in a weatherproof box.
2. Spare 4" nozzles in the cover extending to surface level to permit sampling.
3. Dry wells adjacent to the tanks to collect material accumulated by the concrete pads on which the tanks rest. These wells rise to the surface from where samples of the leakage may be taken.

The temporary storages are allowed to fill alternately so that the material collected may be tested for contamination before discharged to the ponds or to the permanent solution storages.

The ponds are allowed to fill alternately so that a sample of the material collected may be tested for contamination before being discharged to the creek. If necessary, the material may be diluted before discharge or allowed to discharge slowly, or in portions at favorable times.

## Procedure for Handling Leaking Storage Tanks

While the possibility of leakage is remote, if a storage is found to be leaking, a standpipe is inserted through the spare 4" nozzle in the cover, and the contents are transferred to another tank. Following this, the tank is allowed to stand several weeks to permit the radioactivity to subside as much as possible. After this, it is flushed with water which is sent to one of the ponds for further dilution. This diluted wash water is tested as usual before discharge to the creek. Flushing is continued until a safety meter shows the interior of the tank to be suitable for entrance.

When the tank has been cleaned to this point, the earth fill is removed to permit inspection, at which time the tank should be filled with water again to permit location of the leak. After finding it and emptying the water, the leak should be repaired and the tank tested by refilling with water. When satisfactory, it may be put back in service.

This procedure is not fixed, and will, of course, be modified to suit the particular conditons.

## Leaking Stainless Drain Lines

These should be flushed with water and diluted nitric acid and tested for radioactivity before personnel are allowed to work on them. Here, again, conditions will alter the procedure used.

## Surveillance Schedule

The following inspection procedure is used to insure the safe storage of radioactive wastes. The frequency of these inspections may be altered as additional information becomes available.

1. The temperature of the contents of each storage tank should be checked often enough to insure satisfactory storage.

2. The liquid level in each storage should be checked each shift.

3. The dry wells should be checked daily for tank leakage.

4. The activity of the tank contents should be checked as often as necessary for information and control.

5. The contents of tanks 102 and 103 should be sampled and tested for activity before discharging.

6. The contents of the ponds should be sampled and tested for activity before discharging.